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快速计算分层粗糙面散射的FBM/SAA算法

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摘要：

为快速获取分层粗糙面的电磁散射特性，提出一种结合前后向迭代算法（forward-backward method, FBM）与谱积分加速法（spectral accelerate algorithm, SAA）的快速算法（FBM/SAA），该算法的计算量和内存均与粗糙面离散剖分产生的未知量同量级 （O(N)） 。建立了分层粗糙面上关于未知电流分布的电场积分方程并采用矩量法（method of moment, MoM）将其离散为矩阵方程；在用FBM对矩阵方程进行迭代求解过程中，采用SAA技术加速计算矩阵和矢量乘积以快速求解；将FBM/SAA应用于三层媒质分层粗糙面的双站散射系数的计算，计算结果与传统MoM和FBM相一致，证明了算法的有效性；分析了粗糙面参数不同情况下算法的收敛性，比较了传统MoM和FBM/SAA所耗费的CPU时间。结果表明，在计算较长分层粗糙面的散射时，FBM/SAA具有明显优势。

关键词： 分层粗糙面 前后向迭代法 谱积分加速法

Forward-backward method with spectral acceleration algorithm for fast calculation of EM scattering on layered rough surfaces

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Abstract:

To investigate the scattering of layered rough surfaces, a fast calculation of electromagnetic scattering form layered surface based on the forward backward method (FBM) with spectral acceleration is presented. First, the electric field integral equations of the induced current on the layered rough surface are derived. Secondly, a hybrid approach to the FBM with spectral acceleration algorithm (SAA) is developed. As an example, a layered rough surface with two Gauss rough surfaces is studied. The result is compared with the MoM and FBM, which partly validates the formulation. The accuracy, efficiency and convergence of the method are then studied for rough surfaces with various parameters. As well, the CPU time of FBM/SAA is less than that of FBM.

Keywords: layered rough surface forward-backward method spectral acceleration algorithm

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